Annals of Clinical and Analytical Medicine
Case Report

Permanent brachial plexus injury after ultrasound guided infraclavicular nerve block in a morbid obese patient: A case report and review of the literature

Emine Ozcan[1], Okyar Altas[1], Zohre Okur[1], Ozgur Yagan[2]
[1] Department of Anesthesiology and Reanimation, Basaksehir Çam and Sakura City Hospital, Istanbul
[2] Department of Anesthesiology and Reanimation, Faculty of Medicine, Hitit University, Corum, Turkey

This study was presented as an oral presentation at the 4th Spring Symposium (Anesthesia and patient safety in orthopedic surgeries), Zonguldak, Turkey, 2024

Abstract

This report describes a rare case of permanent brachial plexus injury resulting from ultrasound-guided infraclavicular nerve block in a morbidly obese patient who underwent surgery for a distal radius fracture.

The patient had a body mass index of 61 and experienced chronic pain in the left arm postoperatively, with no improvement in motor function. The EMG results revealed no motor or sensory responses from the left ulnar and median nerves. The patient underwent rehabilitation but suffered from muscle atrophy and bone resorption in the left upper extremity due to chronic loss of motor function. Infraclavicular block can be challenging in obese patients owing to the depth of the nerve plexus and its proximity to the clavicle. Ultrasound guidance and nerve stimulation may enhance the safety and success rate of the procedure. This report discusses the challenges in performing peripheral nerve blocks in obese patients.

Keywords

Brachial Plexus Block, Peripheral Nerve Injuries, Lower Brachial Plexus Neuropathy, Brachial Plexopathy, Costoclavicular Syndrome, Needle-Stick Nerve Injuries, Conduction Blocking Anesthetics

DOI: 10.4328/ACAM.22249 Received: 2024-05-05 Accepted: 2024-06-12 Published Online: 2024-07-26 Printed: 2024-10-20 Ann Clin Anal Med 2024;15(Suppl 2):S96-98
Corresponding Author: Emine Ozcan, Department of Anesthesiology and Reanimation Clinic, Basaksehir Çam and Sakura City Hospital, Istanbul, Turkey.
E-mail: dr.emine3419@gmail.com P: +90 530 159 28 56
Corresponding Author ORCID ID: https://orcid.org/0009-0005-2540-7717
Other Authors ORCID ID: Okyar Altas, https://orcid.org/0000-0002-1262-6073 · Zohre Okur, https://orcid.org/0009-0005-9027-0016
Ozgur Yagan, https://orcid.org/0000-0003-1596-1421

Introduction

Brachial plexus blocks, a widely used anesthetic practice, offer both anesthesia and postoperative analgesia. Compared to general anesthesia, regional anesthesia provides better results when proper surgical conditions and analgesia are ensured. Regional anesthesia is preferred for several reasons, including patient consciousness during surgery, unaltered respiratory function, preserved airway reflexes, and postoperative analgesia. Brachial plexus blocks are particularly beneficial for upper extremity surgeries, as they can prevent potential complications of general anesthesia, such as postoperative respiratory issues in patients with low effort capacity, morbid obesity, sleep apnea syndrome, or gastric aspiration due to vomiting in full patients. The brachial plexus block can be administered at different levels, including interscalene, supraclavicular, infraclavicular, axillary, or midhumeral [1]. Complications may occur after the block, including pneumothorax, hematoma, diaphragmatic paralysis, Horner's syndrome, dyspnea, chronic pain, infection, local anesthetic systemic toxicity, and nerve injury [2]. In this case report, we present a morbidly obese patient who experienced permanent brachial plexus injury and associated complications following an ultrasound-guided infraclavicular nerve block for distal radius fracture surgery.

Case Report

A 45 years old, 168 cm, male, 173 kg body mass (BMI, 61) underwent surgery at an orthopedic clinic in a different hospital for a left distal radius fracture due to a fall performing ultrasound-guided infraclavicular nerve block in August 2022. The patient had no systemic disease other than hypertension or hypercholesterolemia. A patient who underwent infraclavicular block using USG reported a painful burning sensation in the hand during the procedure. During the 4-hour operation, the patient experienced pain, and the block was performed a second time under USG guidance. The patient did not return motor function to the left arm postoperatively. After the splint was removed 1 month postoperatively, the patient who could not move the fingers of the left hand and lift the arm was referred to the physical therapy and rehabilitation clinic. EMG performed 4 months after the operation showed no motor or sensory responses from the left ulnar and median nerves. The rehabilitation continued with EMG recorded in January 2023, which also showed no changes. The patient was admitted to the hand surgery outpatient clinic of our hospital in March 2023. Necessary examinations were requested with a preliminary diagnosis of brachial plexus injury. During the ongoing rehabilitation process, partial improvement was reported on the April EMG. In May 2023, a moderate response with low amplitude in the 1-2-3rd fingers. Pregabalin 300 mg/day was initiated because of chronic pain. During this period, muscle atrophy, bone resorption, and edema started in the left upper extremity of the patient, who had been immobile for the last 1 year. Stellate ganglion blockade was performed by an algology clinic in an external center, but it did not have a significant effect. A T-score of BMD of 0.415 g/cm2 4.9 (a 40% decrease compared to the contralateral side) on wrist bone densitometry compared to the contralateral side was reported as significantly low and considered as osteoporosis with a high risk of fracture. Physical therapy for patients who still experience pain is ongoing.

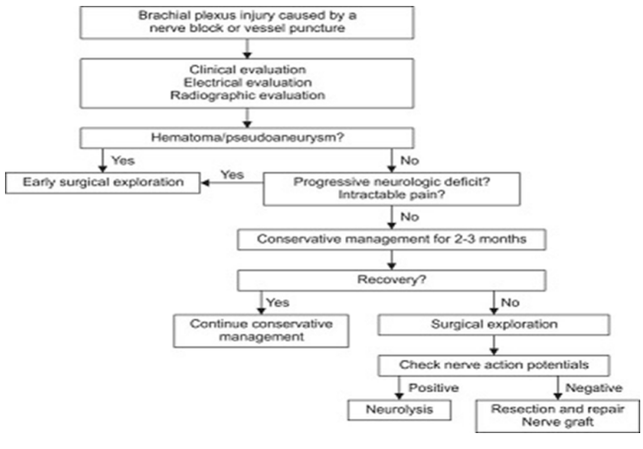

Figure 1. Flowchart for the treatment of brachial plexus injury caused by a nerve block or vessel puncture

Discussion

Infraclavicular block (ICB) offers anesthesia and pain relief for the elbow, forearm, wrist, hand, and fingers [1]. While axillary and supraclavicular blocks can also be used for these procedures, ICB has certain drawbacks such as the block's depth and proximity to the clavicle. The depth of the block may make it challenging to visualize the nerves, especially in patients with obesity, and may require the use of low-frequency ultrasound. The use of ultrasound guidance, nerve stimulator guidance, or a combination of both can be helpful in performing ICB. Some practitioners opt to use nerve stimulation and ultrasound guidance simultaneously [3]. Nerve stimulation may be employed to confirm needle tip placement in ultrasound-guided IKB, particularly when the ultrasound image is unclear or difficult to obtain due to factors such as obesity or challenging positioning [4]. ICBs are generally safe, with few reported complications. However, complications common to all peripheral nerve blocks, such as nerve injury, bleeding, LA systemic toxicity, and infection, can occur. When performed by experienced specialists with appropriate equipment and under ultrasound guidance, peripheral nerve blocks in obese patients have relatively high block success rates. Nevertheless, obesity may increase the difficulty of performing peripheral nerve blocks and is associated with higher block failure rates. Regional anesthesia rarely causes peripheral nerve injuries, which are usually temporary, lasting from days to months. In studies, the incidence of major complications leading to permanent nerve damage was found to be between 0.015% and 0.09 [5, 2]. The Mechanisms include trauma from the infusion needle, hematoma formation, and neurotoxicity from local anesthetics. A clinical evaluation is necessary, which includes assessing symptoms and conducting imaging tests such as MRI, USG, and EMG. Neurological symptoms can range from mild to severe, including sensory or motor loss. In acute-onset painful plexopathy, it can be difficult to differentiate between true weakness and reduced exertion due to pain. Muscle atrophy may not be evident for several weeks, and tendon reflexes may be reduced in weak muscles. Sensory loss usually affects the axillary nerve distribution but may extend

to other nerves. EMG is useful in detecting axonal damage in motor nerves, and needle EMG can assess any muscle, making it possible to evaluate the entire plexus. Magnetic resonance neurography is a specialized procedure that visualizes the roots, plexus segments, and peripheral nerves . Ultrasound is more sensitive than conventional MRI for detecting plexus lesions and can provide information about local factors such as nerve edema, thickening, and T2 hyperintensities. It is also used to noninvasively distinguish preganglionic traumatic lesions from postganglionic lesions [6]. The site of injury was determined from neurophysiological measurements and MRI, which matched the distribution of local anesthetic from the nerve block. In our case, the application of clinical doses of local anesthetic resulted in serious and permanent neuropathy. We attribute this to factors such as intraneural injection due to suboptimal USG imaging due to obesity, or repeated block procedures that pose a risk of neural trauma or neurotoxicity of local anesthetics. Treatment for brachial plexus injuries typically involves immediate initiation of physical therapy and rehabilitation, tailored to the individual needs of each patient. Conservative treatment may be attempted if the fascicles are intact and the degenerative process is not permanent. This may involve the use of analgesics, antidepressants, antiepileptic drugs, and membrane stabilizers. In some cases, ketamine and systemic glucocorticoids may also be used . Early evacuation of hematoma within 4 hours can significantly alleviate symptoms. Sensory changes that occur following axillary artery puncture may indicate plexus damage due to hematoma formation as an early sign. Surgery is recommended if the sensory or motor disturbances persist. (excision of the damaged segment and nerve autograft). Figure 1 shows a flowchart of the treatment of brachial plexus injury caused by a nerve block or vessel puncture [7]. To prevent nerve injuries, possessing thorough anatomy knowledge and experience is essential. Avoid deep sedation and encourage patients to report any numbness/paresthesia during nerve block or venipuncture. Major risk factors for neurological damage after a peripheral nerve block include nerve puncture with a block needle and intraneural injection of local anesthetics. High-pressure intrafascicular injections pose a greater risk of nerve damage [8]. If a patient experiences paresthesia or increased injection pressure, the anesthetic injection should be stopped to minimize intrafascicular injections. In this case, the patient reported a burning sensation and pain during the initial injection. Ultrasound, nerve stimulation, and opening injection pressure can be used to detect needle-nerve contact and intraneural needle placement by monitoring needle placement and injection.

Although rare, trophic changes in the bone after a peripheral nerve injury can occur. In this case, bone densitometry and clinical examination revealed severe osteoporosis in the affected limb, which was caused by immobilization following the radius fracture and the absence of rehabilitation due to nerve injury. Patients should be aware of the risk of pathological fractures and take appropriate precautions, including medical treatment with bisphosphonates, calcium, and vitamin D, and the use of a personalized protective splint. Peripheral nerve blocks, though rare, are among the most common disabling complications of anesthesia, with likely underreported incidence due to medical-legal and institutional reputation consequences. This resulted in the patient's retirement and a 71% disability rate, ending their work life. Acknowledging the psychosocial problems faced by the patient and potential medicolegal challenges faced by the doctor highlights the significance of this issue.

Conclusion

In upper-extremity surgery, brachial plexus blocks are commonly used instead of general anesthesia due to their advantages, particularly in patients with respiratory system pathologies and obesity. Among the various types of peripheral nerve blocks, infraclavicular blocks are frequently used. Although the occurrence is rare, adverse outcomes may arise from inexperience or patient-related comorbidities. Recent years have seen the widespread use of ultrasonography (USG), which has contributed to a decrease in complication rates. However, for morbidly obese patients, USG may not be sufficient to prevent complications and create adequate blocks, as demonstrated in our patient undergoing upper-extremity orthopedic surgery. We suggest that the use of USG-guided nerve stimulators in peripheral nerve blocks may help ensure patient safety and reduce the risk of complications in such cases.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1. Stav A, Reytman L, Stav MY, Portnoy I, Kantarovsky A, Galili O, et al. Comparison of the supraclavicular, infraclavicular and axillary approaches for ultrasound-guided brachial plexus block for surgical anesthesia. Rambam Maimonides Med J. 2016;7(2):e0013.

2. Auroy Y, Benhamou D, Bargues L, Ecoffey C, Falissard B, Mercier FJ, et al. Major complications of regional anesthesia in France: The SOS Regional Anesthesia Hotline Service. Anesthesiology. 2002;97(5):1274-1280.

3. Beh ZY, Hasan MS, Lai HY, Kassim NM, Md Zin SR, Chin KF. Posterior parasagittal in-plane ultrasound-guided infraclavicular brachial plexus block-a case series. BMC Anesthesiol. 2015;15:105.

4. Blanco AFG, Laferrière-Langlois P, Jessop D, D'Aragon F, Sansoucy Y, Albert N, et al. Retroclavicular vs Infraclavicular block for brachial plexus anesthesia: A multi-centric randomized trial. BMC Anesthesiol. 2019;19(1):193.

5. Nielsen KC, Guller U, Steele SM, Klein SM, Greengrass RA, Pietrobon R. Influence of obesity on surgical regional anesthesia in the ambulatory setting: An analysis of 9,038 blocks. Anesthesiology. 2005;102(1):181-187.

6. Upadhyaya V, Upadhyaya DN. Current status of magnetic resonance neurography in evaluating patients with brachial plexopathy. Neurol India. 2019;67(Supplement):S118-S124.

7. Kim HJ, Park SH, Shin HY, Choi YS. Brachial plexus injury as a complication after nerve block or vessel puncture. Korean J Pain. 2014;27(3):210-8.

8. Hadzic A, Dilberovic F, Shah S, Kulenovic A, Kapur E, Zaciragic A, et al. Combination of intraneural injection and high injection pressure leads to fascicular injury and neurologic deficits in dogs. Reg Anesth Pain Med. 2004;29(5):417-423.

How to cite this article:

Emine Ozcan, Okyar Altas, Zohre Okur, Ozgur Yagan. *Permanent brachial plexus injury after ultrasound guided infraclavicular nerve block in a morbid obese patient: A case report and review of the literature. Ann Clin Anal Med 2024;15(Suppl 2):S96-98*